so that the floor of the saloon will, under all circumstances, be very nearly level.

The *Bessemer* is 350 ft. long, 40 ft. wide along the deck-beam, and 64 ft. wide across the paddle-boxes. She will be propelled at a speed of eighteen to twenty miles an hour by two pairs of engines of the collective indicated power of 4,600 horses. The centres of the two pairs of paddle wheels will be about 106 ft. apart.

The *Bessemer* saloon contains the main saloon, which is about 40 ft. long by 29 ft. wide, and 20 ft. high, six spacious retiring rooms, a refreshment room, lavatories, store rooms, &c. The decorations and fittings of the main saloon will be of the very best description, Mr. Bessemer having given this branch of the design his most careful attention. The retiring rooms, as well as the main saloon, are ventilated and heated by a very ingenious arrangement of fans, pipes, &c., which supply and exhaust air in an almost imperceptible manner.

Between the paddle-boxes on either side, and on the upper deck at the middle of the vessel, there are numerous private cabins for the accommodation of first-class passengers, and all of these cabins will be fitted up in a manner that will help to make the journey across the Channel as pleasant as possible. In addition to these, at one end of the vessel between the decks there is a fixed saloon about 52 ft. long, for second-class passengers. The luggage will be stowed in the hold at the opposite end of the ship to this fixed saloon, and two very ingeniously contrived hydraulic luggage cranes, fitted by Messrs. Brown, Bros., will be employed for lifting luggage off the pier and depositing it in the luggage hold, and *vice versâ*, in a very expeditious manner.

The *Bessemer* saloon, however, will be by far the finest cabin that has ever been fitted in a ship. Its great size and height enables it to be ventilated imperceptibly, and will prevent passengers who use it from feeling the unpleasant sensations usually connected with going below. But one of the great advantages of this saloon is, that whatever motion the ship may take from the waves—and this, from the adaptation of her form to passivity among Channel waves, will be slight—the saloon will be practically free from it. It is in the middle of the ship as regards length and breadth, and the axis of rotation is at a height where there is least motion, so that as regards its position it is one in which the vertical and lateral motions produced in every part of the ship by the pitching and rolling will be small, and usually scarcely appreciable. The saloon also will have very little pitching motion, for the form of the vessel renders it impossible for the sea of the Straits of Dover to raise her low freeboard ends very considerably; and even the small effects produced at the ends of the ship will be reduced to about one-seventh at the extremities of the saloon.

From the foregoing remarks it is evident that everything that promises to secure the passengers immunity from sea-sickness has been provided. In the saloon rolling and pitching motions will not be inconveniently felt, and any lateral or vertical movements that may be set up in the ship (and these must be obviously small when the main features of the design for preventing them are taken into account) will only be communicated to the saloon to the extent to which they exist at that part of the vessel where they are necessarily small.

It was intended by Mr. Bessemer to keep the floor of the suspended saloon level by means of an automatic apparatus which involved both the principle of the gyroscope and of Barker's mill. Certain practical difficulties, however, have led him to abandon that idea for the more simple and less costly plan which we will now attempt to describe. Immediately outside one of the ends of the saloon, and attached to the frames of the vessel, there is a pair of powerful pumping-engines. These engines keep up a constant supply of water to a large cylindrical accumulator. The hydraulic pressure so obtained is transmitted through pipes which pass through the hollow axle supporting the nearest end of the saloon to a very ingeniously contrived cylindrical slide balanced valve, which is placed on the athwartship floor girders near the middle of the saloon. The hydraulic pressure is next transmitted through the valve and through another system of pipes to two tipping cylinders, which are fitted one on each side of the vessel at the middle of the length of the saloon. These cylinders have their lower ends attached to two very strong athwart-ship girders, while the upper ends of the piston-rods are connected to the lower side of the upper deck. It will be readily perceived that the forces necessary to keep the floor of the saloon level are exerted on the ends of the athwartship girders just mentioned by means of the two sets of tipping gear. The direction of application of the hydraulic pressure on the pistons in the tipping cylinders is governed by means of a system of levers connected with the equilibrium valve. Near the end of the primary lever, and on its upper side, is fixed a spirit-level, and the man whose duty is to work this lever regulates the distance through which he elevates or depresses the primary lever, so as to keep the air-bubble as near as possible coincident with the central mark on the level. It is assumed by this arrangement that when the spirit-level is "well" the floor of the saloon will be level, whatever rolling motion the vessel herself may have; and since this level is placed near the centre of gravity of the vessel where the angular motion is generally least, there can be no doubt that the saloon will at all times be pretty uniformly level.

THE ENCYCLOPÆDIA BRITANNICA

The Encyclopædia Britannica. Ninth Edition. Edited by Prof. Spencer Baynes. Vol. I. A to ANA. (Edinburgh: Adam and Charles Black.)

THE first volume of the ninth edition of the "Encyclopædia Britannica" has just been issued, handsomely printed and copiously illustrated.

The first edition of this venerable work was announced rather more than a century ago, as it began to be published in parts in the year 1771. The projector of the work was an Edinburgh printer of the time, Mr. Colin M'Farquhar, and the editor and chief compiler was Mr. Smellie, also a printer. Another gentleman associated in the production of the work was Mr. Andrew Bell, a well-known Edinburgh engraver of the period.

The first edition ignored biographical, historical, and geographical matters; but these subjects were effectively introduced in the second edition, and have formed an important feature in subsequent issues. The second edition was in every respect an improvement on its predecessor, and being extended to ten volumes, room was found for the extension and elaboration of many important topics.

The second edition was not, like the first edition, a mere compilation. The proprietors had early seen the necessity of employing the most talented men they could find to contribute the results of their special studies in literature and philosophy, and several eminent men of the period earned honourable remuneration by writing for the work; indeed, it is to the earlier editors of the "Encyclopædia Britannica" that scientific men owe it that their literary labours came so early to have a recognised money value. In the third edition, which was commenced early in 1788, the system of obtaining the best articles in physical science and literature from those who had made these subjects a special study was continued and extended, adding greatly to the value of the work. Mr. M'Farquhar, the proprietor, contributed very largely to its success by the unremitting attention which he bestowed on the editorial department. His labour in connection with the third edition, all the earlier portions of which he edited himself, had such an effect upon his health that he died in the fiftieth year of his age. Dr. Gleig, of Stirling, afterwards Bishop of Brechin, who had been a voluminous contributor, was offered and accepted the editorship after the third edition had been begun. This learned gentleman aided in giving that high tone to the "Encyclopædia" which it afterwards maintained under the editorial supervision of Mr. Macvey Napier and Dr. Traill, and which, judging from the first volume, it is likely to maintain under the editorial superintendence of Prof. Spencer Baynes.

The services of Prof. John Robison, of the University of Edinburgh, were secured at an early stage, and that gentleman ultimately became a very voluminous contributor to the third edition. He *renewed* the article on *Optics*, and jointly with the editor produced the article on *Philosophy*. He also contributed the articles on *Physics*, *Resistance*, *Specific Gravity*, *Tides*, *Telescopes*, and numerous others. To a supplement of two volumes which was ultimately added to the third edition Robison was also a voluminous contributor; for this portion of the work he wrote many of the scientific articles, including *Astronomy*, *Dynamics*, *Electricity*, *Magnetism*, *Thunder*, *Trumpet*, and *Watchwork*. Prof. Robison undoubtedly did much to render the "Encyclopædia Britannica" the great work which it has become.

The issue of the third edition of the "Britannica" was completed in 1797 in eighteen volumes. Constable, at that time rising into fame as a great publisher, acquired the copyright of the supplement to that edition for the sum of 100*l*. Before long a fourth edition was called for, which was published in twenty volumes and completed in thirteen years from the time at which the third edition was finished. This edition was quite as successful as any of those which preceded it. It was edited by Dr. James Miller, and under his auspices the system of having the greater portion of the matter supplied by specialists was largely extended, and with the greatest possible advantage to the work.

After this time a new chapter in the history of the "Encyclopædia" begins. Mr. Constable ultimately acquired the copyright, and at once set to work with his usual enthusiasm to improve the book, beginning with preparations for the issue of a "great" supplement, in emulation of the French work which had been the literary sensation of its time. This supplement was placed under the editorial charge of Mr. Macvey Napier, and the aid of Dugald Stewart was obtained as a contributor of one of the celebrated preliminary dissertations. His was on the History of Metaphysics and Ethical and Political Philosophy; the other dissertation was, if we mistake not, left unfinished by Playfair; it was upon Mathematics and Physical Science. This work was completed by Sir James Mackintosh and Prof. Leslie. Constable felt, when he had obtained the services of an eminent man like Stewart, and also of Davy, that he was entitled to ask all the great literary and scientific men of the day to aid him in his undertaking. He did so, and among the splendid list of contributors which he gathered around him were to be found the names of Arago and Biot.

A large sum of money in addition to the amount paid for the Dissertations was expended on the supplement; and there is no doubt that the public owe to the liberality and energy of Archibald Constable all the best features of the great work as it now exists. The supplement was ultimately and properly incorporated into the future editions of the work, the sixth and seventh editions of which were edited by Mr. Macvey Napier. It is unnecessary further to follow the literary fortunes of the book. Archbishop Whately and Prof. Forbes contributed each an additional dissertation. It would take up too much of our space to give a list of all the distinguished contributors to the seventh and eighth editions of the "Encyclopædia Britannica," many of whom were of world-wide celebrity at the time when they wrote, and many more of whom, then comparatively obscure, have since become famous.

Coming now to the ninth edition, it would not, we think, be any exaggeration to say that the first volume contains as much matter as the three "ill-furnished" quartos which embraced the whole contents of the work as originally projected. From being a mere compilation, the "Britannica" under previous editors had become a work of national importance, containing original treatises on science, art, and literature, by famous literary and scientific men. A glance at the first instalment of this issue warrants us in declaring that the work will lose nothing from having been entrusted to Prof. Baynes. Although he possesses what may be called a perfect mine of art, science, and philosophy in the preceding edition, it must not be forgotten that twenty years have elapsed since it began to be issued. During that period science and art have made vast strides, and history has not been standing still. In biography there are many new names to add to the list of the illustrious dead; and in geography, and trade and manufactures, many radical changes have taken place.

The two previous editions of the work began with the celebrated "Dissertations" to which allusion has already been made; but the present issue commences at once, if we except a brief and well-written preface, with the proper matter of the book in alphabetical sequence.

All mere dictionary "words" have now been excluded from the "Britannica" by Prof. Baynes, who has thus gained a great deal of space for the illustration of more important matter. Those who have an opportunity of comparing the present with former editions will note the advantage of this plan. In the matter of biography great changes will doubtless be introduced, and mere locality will now cease to have an influence in this department; already, we observe that the account of Dr. Adam, an eminent Scotchman of the olden time, has been compressed into a few lines, and a similar plan will doubtless be adopted throughout the work—(though parenthetically let us ask why Aberdour on the Forth, an insignificant watering-place, should have a place, while Aberdour in the north of Aberdeenshire, notable in early Scottish history, and in "the grand old ballad of Sir Patrick Spence," be ignored?) On the other hand, subjects that have become important in our day are discussed at sufficient length, and a fair balance is kept up in the allocation of space. *Adulteration* may be cited as an example of what we mean. The article on that subject has been entrusted to Dr. Letheby, and it very profitably occupies seven times the space formerly allotted to it. The article *Æsthetics* has grown from a few lines into an excellent treatise, occupying no less than twelve pages of the new edition. Prof. Huxley has had over twenty pages allotted to his masterly article on *Amphibia;* he also contributes *Actinozoa. Agriculture* is discussed at a length suited to its importance; the article is divided into twenty-one chapters, and occupies 125 pages, and it is needless to say that it embraces an account of the latest discoveries and improvements in farming, including descriptions of what has been achieved by steam power. The article on *America* occupies forty-eight pages, and seventeen pages besides have been devoted to a disquisition on *American Literature,* by Prof. Nichol, of Glasgow, the son of the author of the "Architecture of the Heavens." The fact that the article *Alps* is by Mr. John Ball is a guarantee of its completeness and accuracy; the names and heights of all the chief peaks of the different ranges and groups are given. A most elaborate dissertation, by Prof. Turner, on *Anatomy,* occupies 109 pages of the volume, which concludes with that subject. There is an interesting biographical sketch of *Agassiz. Afghanistan* and *Africa* are, of course, brought up to the latest date. The treatise on *Algebra* has been revised—re-written, indeed—by Kelland; and in a recent number we alluded to Mr. Wallace's careful paper on *Acclimatisation.*

Prof. Baynes has taken the only safe method of securing articles that shall embody the fullest, and highest, and most accurate knowledge; viz., by obtaining the services of those who have proved themselves to be at the summit in their particular departments. To the present and to future generations, therefore, this ninth edition of the "Encyclopædia Britannica" must be regarded as indicating the highest tide-mark of the science, literature, and art of the time; and from this point of view the successive editions of the book are peculiarly interesting as showing the progress of knowledge during the periods that have elapsed between the times of their publication. We suspect that no edition will have required more modifications to bring it abreast of the time than the present one; and, as we have said, Prof. Baynes has taken the best possible means to accomplish this purpose. In whatever other light it may be viewed, it must, when complete, be regarded as a magnificent collection of masterly treatises in every department of human learning.

This is scarcely the place, nor have we the space, to criticise the plan of the work. For mere purposes of ready reference, we suspect that less gigantic works will be found more useful. A really useful encyclopædia, one that would serve the first and chief purpose of such a work—a book of reference that may with the utmost facility be consulted at any time for information concerning any topic—should have its headings subdivided to the utmost possible limits. This will by many be considered the weak point of the "Britannica," and must be so, so long as the publishers insist on its being mainly a collection of elaborate treatises. This objection may to some extent be obviated by a thoroughly exhaustive index; but if an index is to be the chief apparatus for consulting an encyclopædia, then why not base the subdivision of the work on a logical and not on the alphabetical method?

But in view of the value of the "Britannica" as a treasury of the highest science and learning of our time, —and the publishers, we think, are justified in still retaining this as its chief characteristic—these objections may be considered as of minor importance; and of its value from this point of view there can be no manner of doubt. Prof. Baynes has already justified the choice made of him as editor, and shown himself in all respects competent to be the leader of such a splendid undertaking. We congratulate him on the success he has achieved, and wish him health and strength to carry on the work to its conclusion.

BROWN'S "MANUAL OF BOTANY"

A Manual of Botany, Anatomical and Physiological, for the use of Students. By Robert Brown, M.A., Ph.D., F.L.S., F.R.G.S. (Edinburgh: Blackwood, 1874.)

AT the present time there is a manifest want of an English text-book *au courant* with the modern state of those branches of botanical science which have to do with the minute structure, morphology, and physiology proper of plant-forms. The best that we have are often little more than introductions to the classificatory study of flowering plants. They give copious definitions and illustrations of the technical language which is needed in drawing up descriptions for the purposes of what are known as "systematic" works, but they have little to say —and that little is altogether out of date—about the important and various types which are lumped together as Cryptogams.

This state of things is obviously unsatisfactory. If the study of Biology proper is ever to make any progress amongst us, it must base its principles upon a comprehensive study of all living forms, and draw its illustrations from a wide survey of the vegetable as well as of the animal kingdom. If evolution is to be as fertile a principle in the investigation of vegetable as it has been in the case of animal development, it must take, in its own domain, as wide a scope. Lastly, if we are to turn